Ref. No.: Ex/AM/ME/T/1A/2018(S)

B.E. Electrical Engineering - First Year - First Semester (Old) Supplementary Exam. - 2018

Engineering Mechanics

Full marks 100 Duration 3 Hrs

Answer any five questions.

1. For the crusher shown in Fig. (1) there are two links AB and two links AOD, with one pair of linkages on each side of the stationary portion of the crusher. Also, pin B is on the vertical centerline of the can. Finally, note that small square projections E of the moving jaw move in recessed slots of the fixed frame.
    a. Draw the free body diagrams (showing dimensions and angles) for the links AOD, AB and the piston B.
    b. Identify the two-force and three-force members.
    c. Write down the equations of equilibrium.
    d. Solve the equations of equilibrium to find out the crushing force on the can.

[8+3+3+6=20]

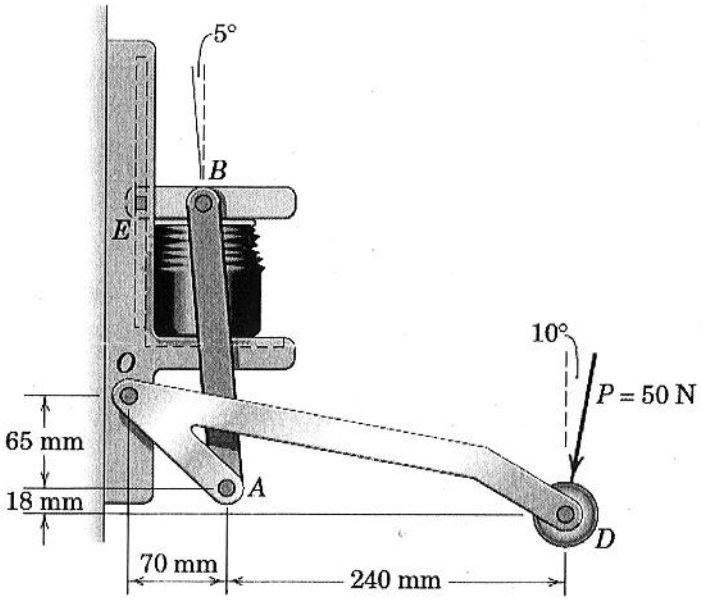

Figure (1)

[Turn over

2. For the composite section shown in Fig. (2),
   a. Find out the x coordinate of the centroid.
   b. Volume of revolution about$y$ axis.
   c. Centroidal I_{yy}. [6+6+8=20]

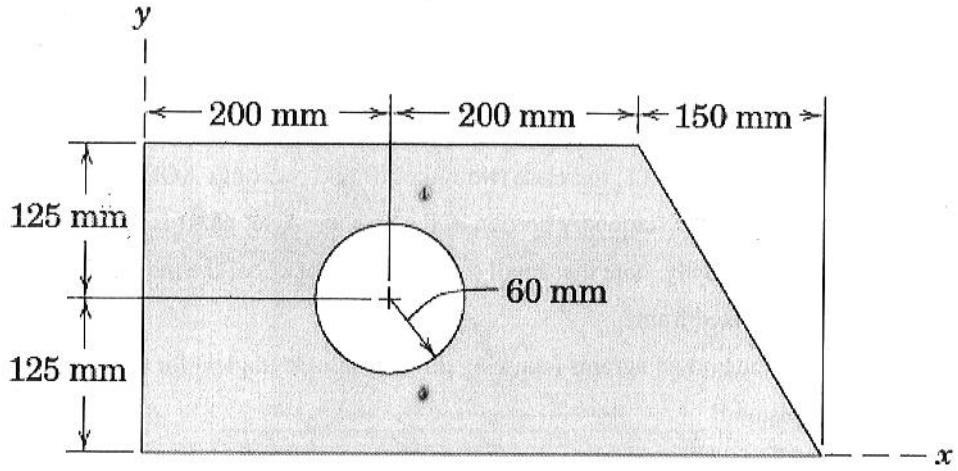

Figure (2)

3. Answer the following questions-
   a. A loaded wheelbarrow is placed on a rough incline. The combined weight of the wheelbarrow and its load acts at the center of gravity G. Determine the maximum angle θ for which the wheelbarrow will not slip.Neglect all friction associated with the front wheel B. Dimensions are in millimeters.
   b. Replace the two forces and single couple by an equivalent force–couple system at point A. [10+10=20]

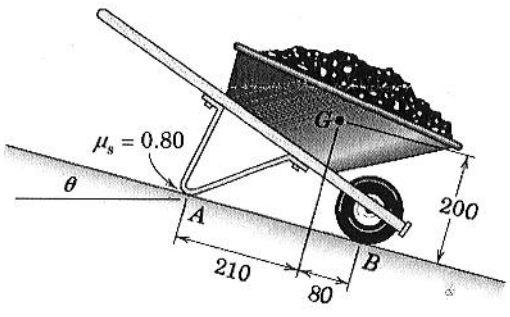

Figure (3a)

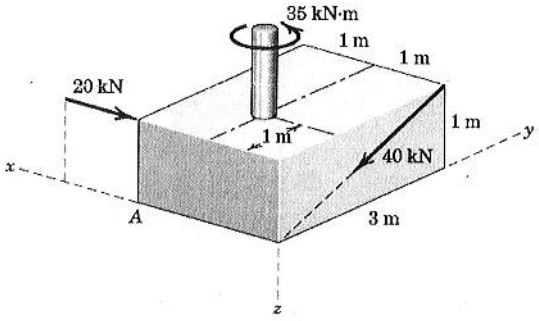

Figure (3b)

4. The system is released from rest with the cable taut. For the friction coefficients $\mu_s = 0.35$ and $\mu_k = 0.30$, calculate the acceleration of each body and the tension T in the cable. Neglect the small mass and friction of the pulleys. [20]

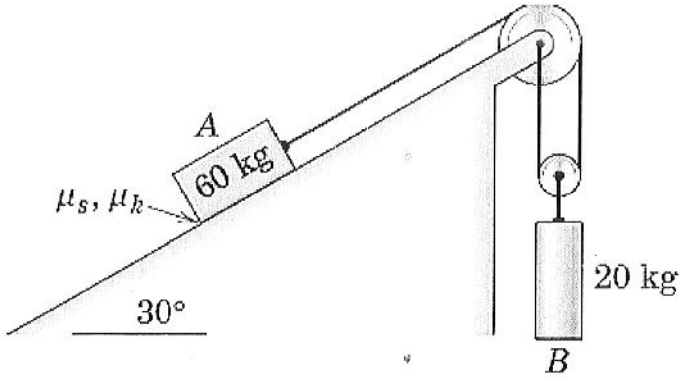

Figure (4)

5. The small cart is nudged with negligible velocity from its horizontal position at A onto the parabolic path, which lies in a vertical plane. Neglect friction and show that the cart maintains contact with the path for all values of k. (Hint: To maintain contact the normal reaction of the ground, $N > 0$. $x - y$ is a vertical plane and the speed at all times $v = \sqrt{2gy}$). Mass of the cart is M. [20]

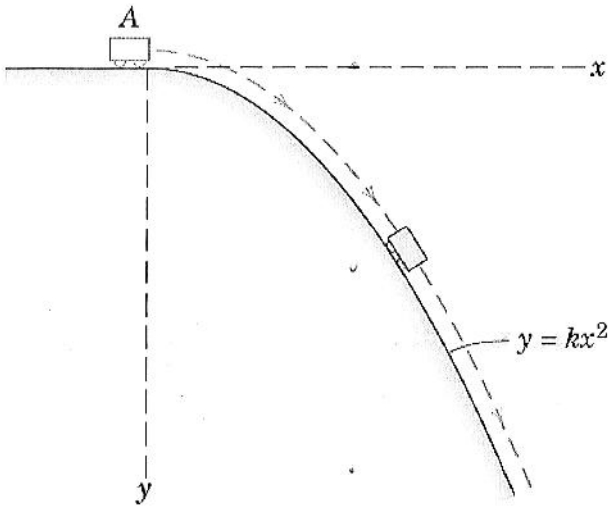

Figure (5)

6. The slider of mass m1 is released from rest in the position shown and then slides down the right side of the contoured body of mass m_2. For the conditions $m_1 = 0.50$ kg, $m_2 = 3$ kg, and $r = 0.25$ m, determine the absolute velocities of both masses at the instant of separation. Neglect friction. [20]

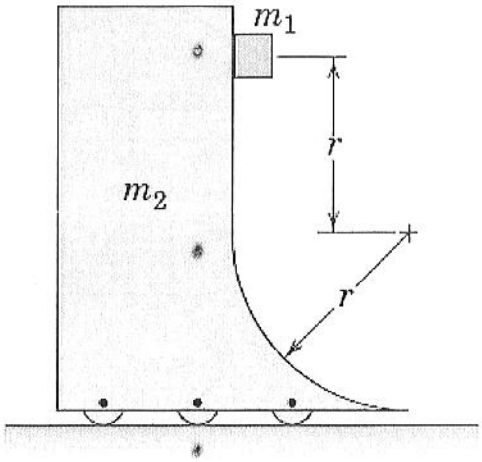

Figure (6)

7. Write short notes with derivations on the following- [5X4=20]
   a. Equilibrium of a three-force member.
   b. Statically determinate and indeterminate structures.
   c. Principle of work and energy method.
   d. Expression for acceleration in $n - t$ coordinate system.